

01FN046US
Amendment dated 02/01/2005

AFTER FINAL: EXPEDITED ACTION

02230028aa
Reply to office action mailed 12/15/2004

The following is a complete listing of all claims in the application, with an indication of the status of each:

Listing of claims:

- 1 1. (currently amended) A magneto-resistance effect element comprising:
 - 2 a lower conductive layer;
 - 3 a free layer provided on the lower conductive layer and having an orientation of magnetization varied by a magnetic field applied thereto, said free layer thereby acting as a magnetic sensing layer changing the orientation of magnetization in accordance with the direction and magnitude of the magnetic field;
 - 8 a non-magnetic layer provided on top of the free layer;
 - 9 a fixed layer provided on the non-magnetic layer and having a pinned orientation of magnetization;
 - 11 a vertical bias layer, provided on said lower conductive layer and not underneath said non-magnetic layer, for applying a magnetic field to said free layer, said free layer being patterned to make an end portion thereof overlap that of said vertical bias layer, and said free layer is greater in length in the direction of a magnetic field applied thereto by said vertical bias layer than said fixed layer, and a sense current for detecting a change in electrical resistance of said non-magnetic layer flows substantially in perpendicular relation to said non-magnetic layer, and
 - 19 an underlying layer for said free layer provided under said free layer, and said underlying layer for said free layer being provided on said vertical bias layer and extending on said vertical bias layer beyond said overlapping portion of said free layer being in contact with said free layer and said vertical bias layer, and said lower conductive layer.

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1 2. (original) The magneto-resistance effect element according to claim 1,
2 wherein said lower conductive layer has a recessed portion on an upper
3 surface thereof, and said vertical bias layer is provided so as to allow at least
4 part thereof to be buried in said recessed portion.

1 3. (canceled)

1 4. (canceled)

1 5. (previously presented) The magneto-resistance effect element according to
2 claim 1, further comprising a vertical bias layer protective layer provided on
3 said vertical bias layer, and said vertical bias layer protective layer being in
4 contact with said vertical bias layer, and said vertical bias layer protective
5 layer being in contact with at least one of said free layer and said underlying
6 layer for said free layer.

1 6. (currently amended) A magneto-resistance effect element comprising:

2 a lower conductive layer;

3 ~~a magnetic layer provided on the lower conductive layer;~~

4 a free layer provided on the magnetic layer and having an orientation
5 of magnetization varied by a magnetic field ~~coupled magnetically to the~~
6 ~~magnetic layer and applied thereto;~~

7 a non-magnetic layer provided on the free layer;

8 a fixed layer provided on the non-magnetic layer and having a pinned
9 orientation of magnetization; and

10 a vertical bias layer, provided on said lower conductive layer and not
11 underneath said non-magnetic layer, for applying a magnetic field to said free

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12 layer, said free layer being patterned to make an end portion thereof overlap
13 that of said vertical bias layer, and said magnetic free layer is greater in length
14 in the direction of a magnetic field applied thereto by said vertical bias layer
15 than said free-fixed layer, and a sense current for detecting a change in
16 electrical resistance of said non-magnetic layer flows substantially in
17 perpendicular relation to said non-magnetic layer, and
18 an underlying layer for said vertical bias layer, wherein said vertical
19 bias layer is provided so as to allow at least part thereof to be buried in a
20 recessed portion on an upper surface of said lower conductive layer so as to
21 provide a gradual slope to an end portion of said underlying layer for said
22 vertical bias layer
23 ~~wherein said magnetic layer is in contact with said free layer and said~~
24 ~~vertical bias layer.~~

1 7. (canceled)

1 8. (original) The magneto-resistance effect element according to claim 6,
2 wherein said lower conductive layer has a recessed portion on an upper
3 surface thereof, and said vertical bias layer is provided so as to allow at least
4 part thereof to be buried in said recessed portion.

1 9. (canceled)

Claims 10-63. (canceled).